IS 10037-2 (1983): Requirements for sludge de-watering equipment, Part 2: Vacuum filtration equipment [CED 24: Public Health Engineering.]

BLANK PAGE


IS : 10037 ( Part 2 ) - 1983
( Reaffirmed 2001 )

*Indian Standard*



# REQUIREMENTS FOR SLUDGE DE-WATERING EQUIPMENT

## PART 2 VACUUM FILTRATION EQUIPMENT

UDC 628·336·42



INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 3

*October* 1983

# *Indian Standard*

# REQUIREMENTS FOR SLUDGE DE-WATERING EQUIPMENT

## PART 2 VACUUM FILTRATION EQUIPMENT

Public Health Engineering Equipment Sectional Committee, BDC 40

| *Chairman* | *Representing* |
|---|---|
| DR B. B. SUNDARESAN | National Environmental Engineering Research Institute ( CSIR ), Nagpur |
| *Members* | |
| SHRI R. PARAMASIVAM ( *Alternate* to Dr B. B. Sundaresan ) | |
| ADVISER ( PHE ) | Ministry of Works & Housing, New Delhi |
| DR S. R. SUKLA ( *Alternate* ) | |
| SHRI S. V. BOPARDIKAR | Directorate General of Technical Development, New Delhi |
| SHRI R. C. P. CHAUDHARY | Engineers India Limited, New Delhi |
| CHIEF ENGINEER | Department of Health, Government of West Bengal, Calcutta |
| SHRI T. N. CHATTERJEE ( *Alternate* ) | |
| CHIEF ENGINEER ( WATER ) | Municipal Corporation of Delhi, Delhi |
| SHRI JAI NARAIN ( *Alternate* ) | |
| SHRI D. K. CHOUDHURY | Geo-Miller & Co, Calcutta |
| SHRI D. R. MALL ( *Alternate* ) | |
| SHRI S. K. DASGUPTA | Calcutta Metropolitan Development Authority, Calcutta |
| SHRI S. J. DUTTA ( *Alternate* ) | |
| DEPUTY MUNICIPAL COMMISSIONER | Municipal Corporation of Greater Bombay, Bombay |
| HYDRAULIC ENGINEER ( *Alternate* I ) | |
| CHIEF ENGINEER ( SEWERAGE ) ( *Alternate* II ) | |
| SHRI B. R. N. GUPTA | Engineer-in-Chief's Branch, Army Headquarters, New Delhi |
| SHRI K. V. KRISHNAMURTHY ( *Alternate* ) | |
| SHRI S. P. JAMES | Local Administration & Social Welfare (F) Department, Trivandrum |
| SHRI R. KRISHNASWAMY | Tamil Nadu Water Supply & Drainage Board, Madras |
| SHRI S. A. JAGDESAN ( *Alternate* ) | |
| SHRI M. Y. MADAN | The Hindustan Construction Co Ltd, Bombay |
| SHRI C. E. S. RAO ( *Alternate* ) | |

( *Continued on page* 2 )

( *Continued from page* 1 )

| *Members* | *Representing* |
|---|---|
| SHRI S. R. MAJUMDAR | Paterson Engineering Co ( India ) Ltd, Calcutta |
| SHRI A. R. MIR | Public Health Engineering Department, Government of Jammu & Kashmir, Srinagar |
| SHRI G. M. KANTH ( *Alternate* ) | |
| SHRI S. S. NAIK | Hydraulic & General Engineers Pvt Ltd, Bombay |
| SHRI D. R. KENKRE ( *Alternate* ) | |
| SHRI R. NATARAJAN | Hindustan Dorr-Oliver Ltd, Bombay |
| SHRI B. M. RAHUL ( *Alternate* ) | |
| SHRI M. M. PATEL | Indian Water Works Association, Bombay |
| REPRESENTATIVE | Public Health Engineering Department, Government of Punjab, Chandigarh |
| REPRESENTATIVE | Public Health Engineering Department, Government of Haryana, Chandigarh |
| SHRI K. K. GANDHI ( *Alternate* ) | |
| PROF S. SUBBA RAO | All India Institute of Hygiene & Public Health, Calcutta |
| SHRI A. V. RAO ( *Alternate* ) | |
| SHRI T. P. SHARMA | M. P. State Prevention and Control of Water Pollution Board, Bhopal |
| DR G. K. KHARE ( *Alternate* ) | |
| SHRI S. S. SRIVASTAVA | Uttar Pradesh Jal Nigam, Lucknow |
| SHRI S. A. SWAMY | The Institution of Engineers ( India ), Calcutta |
| SHRI P. S. TENDOLKAR | Candy Filters ( India ) Ltd, Bombay |
| SHRI C. L. SASTRI ( *Alternate* ) | |
| SHRI M. G. VAIDYA | Public Health Engineering Department, Government of Madhya Pradesh, Bhopal |
| SHRI V. VARADARAJAN | Madras Metropolitan Water Supply and Sewerage Board, Madras |
| SHRI S. DAIVAMANI ( *Alternate* ) | |
| SHRI G. RAMAN, Director ( Civ Engg ) | Director General, ISI ( *Ex-officio Member* ) |

*Secretary*

SHRI A. K. AVASTHY
Assistant Director ( Civ Engg ), ISI

## Waste Water Treatment Equipment Subcommittee, BDC 40 : 2

*Convener*

| | |
|---|---|
| PROF V. RAMAN | National Environmental Engineering Research Institute ( CSIR ), Nagpur |

*Members*

| | |
|---|---|
| SHRI S. K. GADKARI ( *Alternate* to Prof V. Raman ) | |
| SHRI R. R. BAGRI | Clear Water Ltd, New Delhi |
| CHIEF ENGINEER ( DESIGN ) | U. P. Jal Nigam, Lucknow |
| SHRI S. S. SRIVASTAVA ( *Alternate* ) | |
| CHIEF ENGINEER ( SEWERAGE ) | Municipal Corporation of Greater Bombay |
| DEPUTY CHIEF ENGINEER ( SEWERAGE ) ( *Alternate* ) | |

( *Continued on page* 9 )

# *Indian Standard*

# REQUIREMENTS FOR SLUDGE DE-WATERING EQUIPMENT

## PART 2 VACUUM FILTRATION EQUIPMENT

## 0. FOREWORD

**0.1** This Indian Standard ( Part 2 ) was adopted by the Indian Standards Institution on 28 June 1983, after the draft finalized by the Public Health Engineering Equipment Sectional Committee had been approved by the Civil Engineering Division Council.

**0.2** Sludges produced during sewage treatment contain large percentage of water. In many situations it is, therefore, necessary that these should be dewatered so that solids obtained after dewatering can be easily handled and disposed off. The liquid obtained during dewatering is usually returned to the plants inlet. Vacuum filtration is employed to separate a solid from its associated liquid by means of a porous media which retains the solid but allows the liquid to pass.

**0.3** Among the vacuum filters, the revolving type continuous vacuum drum filter is most widely used ( *see* Fig. 1 ).

**0.4** In calculating the size of filter, the desired moisture content of the filter cake is one of the factors. If wetter cake content of the filter cake is acceptable higher filtration rates and lower coagulant dosage can be used. Sometimes for certain sludges, coagulant dosage may not be necessary. The filtration rate is expressed in kg of dry solids per square metre of medium per hour. It varies from 10 kg/m$^2$/h for activated sludge alone to 50 kg/m$^2$/h for primary sludges. A design rate of 15 kg/m$^2$/h is a conservative figure that can be used when the quality of sludge and the type of filter to be used are not known.

**0.5** This standard is being published in three parts. Part 2 deals with the requirements for vacuum filtration equipment. The other parts in the series are given below:

IS : 10037 ( Part 1 )-1981 Requirements for sludge de-watering equipment: Part 1 Sludge drying beds-sand, gravel and underdrains.

IS : 10037 ( Part 3 )-1983 Requirements for sludge de-watering equipment: Part 3 Centrifugal equipment ( solid bowl type ).

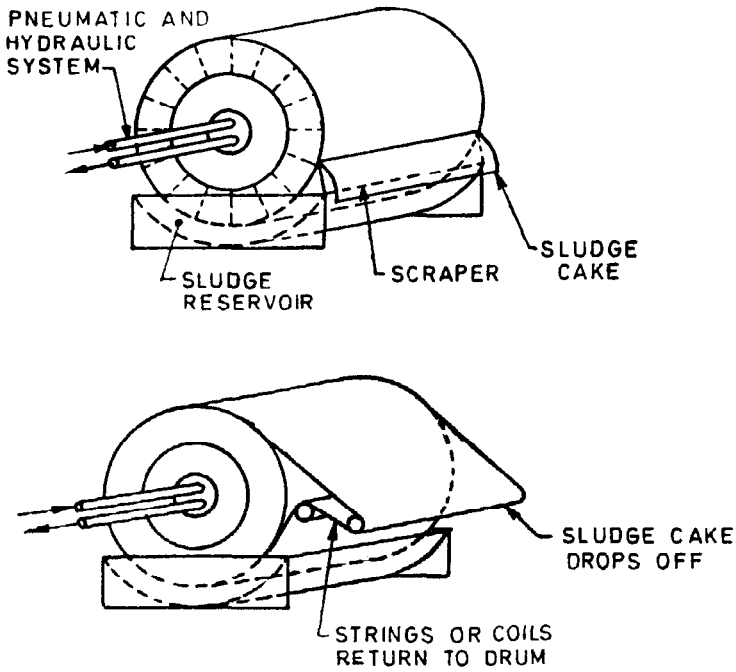


FIG. 1 GENERAL ARRANGEMENT OF DRUM FILTER

**0.6** In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

**0.7** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## 1. SCOPE

**1.1** This standard ( Part 2 ) lays down requirements for vacuum filtration equipment used for sludge de-watering.

*Rules for rounding off numerical values ( *revised* ).

## 2. MATERIALS

**2.1 Drum** — Depending upon the slurry characteristics, the drum may be made out of mild steel conforming to IS : 1977-1975*, mild steel rubberlined conforming to IS : 4682 ( Part 1 )-1968† or stainless steel conforming to IS : 6911-1972‡. For sewage, mild steel should be used for the construction of drum.

**2.2 Vat** — The vat should be made out of mild steel conforming to IS : 1977-1975*.

**2.3 Filter Medium** — The filter medium should be of wool, cloth, felt, synthetic fibre or plastic or stainless steel mesh or coil spring.

## 3. DIMENSIONS

**3.1** The size of the vacuum filter is dependent upon the amount of slurry to be filtered in unit time. Leaf filter test is used for determining the most suitable filter medium and for finding out the extent of conditioning of sludge required prior to vacuum filtration. The procedure of leaf test is given in Appendix A.

**3.2** Generally filters are specified by diameter multiplied by length ( $D \times L$ ).

## 4. DESCRIPTION OF CONSTRUCTION

**4.1** The drum is made of sections and supported horizontally at its trunnions rotating in housed-bearings. The part of the drum is submerged in a steel vat containing sludge and is rotated through worm gear drive or chain and sprocket drive which in turn is driven by electric motor. Internal piping running lengthwise is connected under each sector and placed against a stationary valve, and end of which is connected to the housed bearings and the other to vacuum through receiver and moisture trap.

## 5. OPERATION

**5.1** Valves and piping are so arranged as to apply a vacuum on the inner side of the filter medium.

**5.2** As the drum rotates, each sector comes under vacuum and sucks the slurry which passes through the filter medium placed over the drum. The cake formed on the drum surface may be discharged either by a scraper, string or belt which is part of filter medium. An oscillating

---

*Specification for structural steel ( ordinary quality ) ( *second revision* ).

†Code of practice for lining of vessels and equipment for chemical processes: Part 1 Rubber lining.

‡Specification for stainless steel plate sheet and strip.

agitator forming the part of the filter is provided to keep the slurry in suspension. A vacuum of 500 mm to 650 mercury is generally applied. The drum normally turns at a peripheral speed of 7 to 40 rev per hour ( maximum ). A typical illustration of a vacuum filtration equipment is shown in Fig. 2.

**5.3** The filter run may not exceed 30 hours per week in small plant to allow time for conditioning, clean up and delays. At larger plants, it may work for 20 hours per day.

**5.4** The moisture of filtered cake varies normally from 80 percent in case of raw activated sludge to 70 percent for digested primary sludges.

**5.5** Filters shall be operated to produce a cake of 60 to 70 percent moisture if it is to be heat dried or incinerated.

**5.6** At the end of each filter run, the filter fabric is cleaned to remove sticking sludge. A jet of water is used to clean the filter medium.

**5.7** The filters are usually located in a separate room or building with adequate light and ventilation.

## APPENDIX A

( *Clause* 3.1 )

### LEAF TEST

**A-0.** The main objective of the leaf test is to evaluate the effect of different fabrics, fabric forms and drying times on filter yield. Varying dozes and types of chemicals should also be tested to establish chemical conditioning requirements.

**A-1.** The leaf consists of a metal disc of about 90 $cm^2$ area on which the filter medium is tightly fixed. The leaf filter is submerged in a sludge container of known solid contents. A chemical is added to the sludge in measured quantity and the sludge is kept stirred.

**A-2.** The basic steps in performing a filter leaf test are as follows and should be repeated number of times to optimize the performance of each media tested:

a) Condition the sludge in 9·0 to 25·0 litres containers.

b) Submerge the filter leaf into the sludge slurry and operate the vacuum pump for a varying time with varying vacuum.

c) Gently remove the filter leaf from the sludge slurry to allow the cake to dry for a fixed drying time.

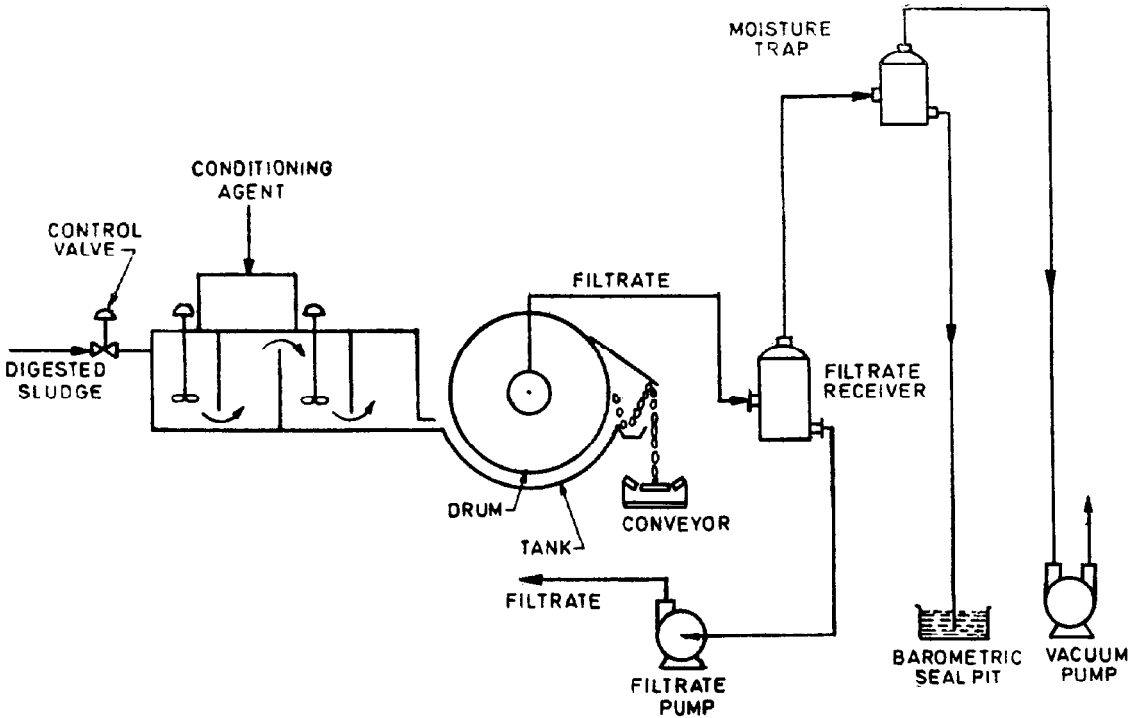


FIG. 2 TYPICAL INSTALLATION OF A VACUUM FILTRATION EQUIPMENT

d) Remove the cake from the filter leaf and measure the weight and moisture content of the cake. Note the cake thickness and separability from the media.

e) Measure the filtrate suspended solid and filtrate volume.

**A-2.1** The filter yield is then calculated using the following equation:

$L$ = Dry sludge weight ( g ) × number of filtration cycles/hours × area of test filter in square centimetres

where $L$ is filter yield in g/cm²/h.

NOTE — A suitable scale up factor should be applied to the result obtained from the above test.

**A-3.** A schematic diagram of the apparatus for leaf test is given in Fig. 3.

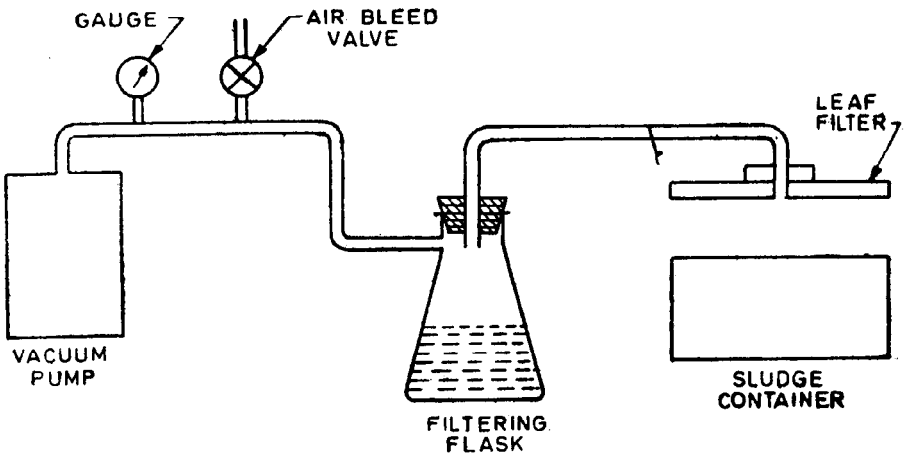


FIG. 3 APPARATUS FOR LEAF TEST

( *Continued from page* 2 )

| *Members* | *Representing* |
|---|---|
| SHRI L. M. CHOUDHARY | Haryana State Board for Prevention and Control of Water Pollution, Chandigarh |
| SHRI M. L. PRABHAKAR ( *Alternate* ) | |
| SHRI M. Y. MADAN | The Hindustan Construction Co Ltd, Bombay |
| SHRI C. E. S. RAO ( *Alternate* ) | |
| SHRI U. C. MANKAD | Geo-Miller & Co Pvt Ltd, New Delhi |
| SHRI D. K. CHOUDHURY ( *Alternate* ) | |
| SHRI S. S. NAIK | Hydraulic & General Engineers Pvt Ltd, Bombay |
| SHRI D. R. KENKRE ( *Alternate* ) | |
| SHRI S. K. NEOGI | Institution of Public Health Engineers India, Calcutta |
| SHRI R. NATARAJAN | Hindustan Dorr-Oliver India Ltd, Bombay |
| SHRI B. M. RAHUL ( *Alternate* ) | |
| SHRI P. N. PASTAKIA | Pennwalt India Ltd, Bombay |
| SHRI V. P. THANGAMUTHU ( *Alternate* ) | |
| SHRI T. P. SHARMA | M. P. State Prevention & Control of Water Pollution Board, Bhopal |
| DR G. K. KHARE ( *Alternate* ) | |
| PROF S. SUBBA RAO | All India Institute of Hygiene and Public Health, Calcutta |
| SHRI A. V. RAO ( *Alternate* ) | |
| SHRI R. SUNDARAM | Kerala State Pollution Control Board, Trivandrum |
| SHRI J. VENUGOPALAN NAIR ( *Alternate* ) | |
| SHRI J. M. TULI | Engineers India Limited, New Delhi |
| SHRI K. MOHAN (*Alternate* ) | |

## INDIAN STANDARDS

## FOR

## PUBLIC HEALTH ENGINEERING EQUIPMENT

IS :

6279-1971 Equipment for grit removal devices

6280-1971 Sewage screens

7090-1973 Guidelines for rapid mixing devices

7208-1974 Guidelines for flocculator devices

7232-1974 Method for Imhoff cone test

8403-1977 Code of practice for construction of clarifier-digester for treatment of sewage

8413 ( Part 1 )-1977 Requirements for biological treatment equipment : Part 1 Trickling filters

8413 ( Part 2 )-1982 Requirements for biological treatment equipment : Part 2 Activated sludge process and its modification

8419 ( Part 1 )-1977 Requirements for filtration equipment : Part 1 Filtration media-sand and gravel

9110-1979 Hand operated augers for cleaning water closet, pipes and sewers

9222 ( Part 1 )-1979 Recommendations for handling and dozing devices for chemicals for water treatment : Part 1 Coagulants

10037 ( Part 1 )-1981 Requirements for sludge dewatering equipments : Part 1 Sludge drying beds — sand, gravel and underdrains

10053-1981 Requirements for equipment for Jackson candle turbidity meter and determination of turbidity

10261-1982 Requirements for settling tank ( clarifier equipment ) for waste water treatment

10313-1982 Requirements for settling tank ( clarifier equipment ) for water treatment plants